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Precooling South Carolina Peaches - 1953

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In conjunction with peach maturity studies conducted in the southeastern states this past season, a number of tests were made on the precooling of Elberta peaches in the Spartanburg area of South Carolina. In view of the apparent need for rapid removal of field heat to control the development of brown rot and Rhizopus rot and reduce bruising injury in fruit shipped at an advanced stage of maturity, it was considered desirable to obtain more data on methods of precooling currently in use. These included the customary precooling of the fruit after loading in refrigerator cars by mechanical trackside units, auxiliary fans or the use of Preco car fans. In addition, since several hydrocoolers were installed at the beginning of this season, information was obtained on their performance in order to determine their value in improving the quality of the peaches reaching the market.

The purpose of these series of tests was two-fold: - 1) to determine the amount of heat removed from the fruit by each method by means of temperature measurements and 2) the effect of precooling on ripening and decay control during transit.

Plan and Procedure

Fruit temperatures were obtained for the most part by means of copper-constantan thermocouples, read with a direct reading, compensated cold junction potentiometer. For temperatures during precooling or after loading of hydrocooled fruit in refrigerator cars, thermocouples, made up into sets of eleven, were used with leads sufficiently long to extend outside of the car so that temperatures could be obtained without opening car doors and upsetting conditions within. These were removed from the car upon completion of the test. Fruit temperatures during hydrocooling were obtained by the use of single thermocouples placed in a basket before the hydrocooling operation and removed after cooling. Nine commodity temperatures and 2 air temperatures were obtained in the cars. Temperatures were measured of fruit in the top, middle and bottom baskets at the bunker, quarter length, and doorway stacks along the centerline of the car. Air temperatures at the top bulkhead open and under the floor rack adjacent to the bottom bulkhead opening were read. The temperature of the fruit was obtained by inserting a thermocouple to the pit in a peach located in the centerline of the basket and approximately 3 to 4 inches from the top.

Readings were taken at hourly intervals when possible during car precooling. Where the car bunker ice was used as the cooling agent, the amount of ice before and after precooling was estimated. No salt was used which is in accord with commercial practice in this area. Precooling was continued as long as possible after the cars were loaded or if custom-cooled with portable fans or mechanical units, they were cooled only 4 or 5 hours as was the general practice.

A total of 8 car precooling tests were made including non-precooled check cars. Two tests were made to determine the temperature change of hydrocooled peaches after loading in pre-iced cars before the cars were moved.

In determining the temperature of hydrocooled peaches, baskets or boxes were taken at random from the packing line, thermocouples were inserted and the container replaced in the line at the receiving end of the cooler. The timing was started as the basket first entered the water and ended just as it cleared the water at the other end when the temperature was immediately checked again. A number of containers were held on the floor for a considerable time after cooling to determine the warming rate of the fruit when exposed to hot summer air temperature. Temperatures were taken at intervals during this period.

One precooling test was made in a new general purpose mechanically refrigerated car which was made available for this test by the carline. Temperatures were obtained during precooling only by the Department observers although transit temperatures en route to New York were obtained by a carline test engineer.

One shipping test to New York was conducted to compare the effects of different precooling methods on temperature, decay development and change in ripeness during transit. Peaches in one test car were hydrocooled, precooled in the car by car fans in another, and non-precooled as a check for the third. All cars were fan cars and moved with the fans on. Each car contained 5 test baskets, made up of fruit from a single lot, which were treated as follows:

1. Shipping maturity - no inoculation - pressure tested
2. Advanced " - " " " "
3. Shipping " - " " - for decay records
4. " " - Brown rot inocul. " "
5. " " - Rhizopus " " "

The baskets were placed in the top layer in each car at the doorway with two containing recording thermometers. Pressure testing and inoculation were done at shipping point on the day of loading. The test packages were all placed in the top layer at the doorway position in each car. They were removed at destination and held at room temperature and inspected daily for decay and ripeness until all peaches were ripe.

Results

Car Precooling

A summary of the data obtained in the various car precooling tests is found in Table 1. Average temperatures in 2 cars precooled with portable fans using car bunker ice for refrigeration and a non-precooled check car are shown in Fig. 1. The precooling fans were rated at about 2600 cfm each. Precooling times were 8.5 hours for Car No. 1 and 8 hours for Car 3. The non-precooled

car was loaded by 3 p.m. and temperatures were recorded until midnight or for 9 hours. The average temperatures upon completion of cooling were 65° F. for Car 1, and 63.5° for Car 3 while the check car was at 75°. Total temperature drop was 10.5° and 21.1° in the precooled and 8.5° in the non-precooled cars. The relatively poor precooling job in Car 1 apparently was due to its having been held over 24 hours after preicing because rain stopped packing one day. This resulted in 1/4 less ice available for precooling than the other precooled car and the bunkers were practically empty at the finish. Also car air temperatures were quite high during precooling as shown in comparison with Car 3 in Fig. 2. This higher air temperature, much higher than usually found during precooling was apparently caused by the ice congealing while standing the extra 24 hours which reduced the surface contacting the air. Ice meltage during precooling was about the same as for the other precooled car although the amount of cooling was much less. The reason for this cannot be explained. Good precooling practice requires that the ice be barred down at the start of precooling to break up the ice mass in the bunkers, which was not done. Average top, middle, and bottom fruit temperatures are shown for all 3 cars in Figs. 3, 4, and 5. In the non-precooled car top layer temperatures were lowered only 2 1/2° to 79 1/2° and fruit temperatures were warm enough to be favorable to the rapid development of decay and ripening. The fruit would not have been cooled very much more by the car fans during the next 12 hours when the car was moved to Spartanburg for reicing and made up into a train for the final move to destination. These warm temperatures show the necessity for precooling to insure against the rapid development of decay. While Car 3 would appear to represent about the best precooling job available in this area, especially as to time precooled which is generally less, its final average fruit temperature of 63.5° is considerably above the 40° generally considered the maximum for a good precooling job on most fruits and vegetables. Good precooling can undoubtedly be accomplished if enough time is allowed for it and the bunkers are re-iced during the operation. The use of salt with the ice would also be helpful in improving the cooling job.

In the shipping tests, one car (No. 8) was precooled with car fans and one (No. 7) was not precooled as a check. These cars were loaded on track at Inman with loading being completed on the fan precooled car at 5:30 p.m. This left only 4 hours for precooling until the cars were pulled. The precooling was done by a custom precooler but regular Preco electric motors were not available. The motors used developed only approximately one-half the fan speed recommended which affected the performance greatly. In addition, a broken hub on the fan shaft in the test end of the car stopped its operation for 1 3/4 hours which further reduced the amount of cooling. Deducting the time the fan was off left only about 2 1/2 hours of precooling which reduced temperatures only 6° F. (Fig. 6). The non-precooled car (No. 7) finished loading only 2 hours before the cars were pulled so that only two readings were made covering a period of 1 3/4 hours. Average temperature drop was 2.2° during this period.

Two cars, Nos. 10 and 11, were precooled with the trackside truck mounted portable precooler. The time usually allotted per car for precooling is about 5 hours, depending somewhat on time available and the number of cars to be

precooled. Car 10 was precooled 5.25 hours and car 11, 4.67 hours. Fig. 7 shows the average fruit temperatures in the top, middle and bottom layers in the car during precooling. Both cars were loaded with 396 bushel baskets and were precooled at the same time but car 10 showed a cooling rate of 4.7° per hour as compared with 3.4° for car 11. This indicates a difference in the performance of the two units although both were rated the same. The final average temperature of 63.9° F. in car 10 is believed representative of the job being done by the mechanical precooling units in the area. It falls far short of being an adequate precooling job.

Individual temperatures were taken with hand thermometers in a number of cars precooled with the trackside mechanical units. These temperatures indicated a rather wide variation in temperatures in the top layer of the load after precooling. Those positions along the side of the car opposite the door in which the unit was located showed lower temperatures than on the near side due undoubtedly to receiving the direct air blast from the machine. Positions in or near the doorway were cooler than those near the ends of the car. Top layer temperatures ranging from 61° F. to 80° were found in one car after precooling.

Mechanically Refrigerated Car

This car was similar to the 40 ft. cars now in use for the frozen food trade using the Frigidaire systems. It was designed as a general purpose car with controls covering a range suitable for carrying all types of perishable commodities at temperatures above 32° F. as well as frozen foods. Cold air was delivered to the lading through a ceiling duct which extended the full width and length of the car and was 6" in depth. The air was discharged from the duct through slots about 2 inches wide across the duct and spaced at approximately 4-foot intervals. These openings were controlled by a hinged flap opening into the duct. For loads of frozen foods these are closed and all air circulates around the load by means of flues at the side and end-walls. For fresh commodities, they are opened and most of the air passes directly into the load space and through the load and slatted floor rack.

Since the dimensions of this car were greater than a standard end-bunker car (8' 11" x 34' 2") a special load had to be devised. A total of 429 bushel baskets were placed in the car in 5-6-5, 6-5-6, 5-6-5 pattern alternating for each tier. Two baskets in each of the 3 layers of each tier had to be inverted making a fairly tight load with less air space than the standard load pattern. The car was loaded with warm fruit of about 90° F. The cooling unit was started at 4:30 P.M. and operated continuously until unloading six days later. During the 14 hours that the car was held on track at Inman after loading, the fruit was cooled to about 64° which represented a reduction of about 20°, Fig. 8. Average commodity temperatures reached 50° about 38 hours after the cooling unit was started and were under 40° during the 3 day holding period at destination. Average temperature at unloading was 34.9°. The tight load and relatively low total air circulation (4500 cfm) for the car are believed largely responsible for the relatively slow cooling rate. The low temperatures ultimately reached and maintained while the car was held on track kept the fruit in good condition, but faster cooling would be desirable for riper fruit or fruit with incipient decay.

Hydrocooled Peaches in Car

Temperatures were obtained in two preiced cars loaded with hydrocooled peaches from loading time until the cars were released for shipment. This period was 5 3/4 hours for car 4 and 4 3/4 hours for car 5. Loading of car 4 was stopped and doors left open for over an hour after the car was about half loaded while another car was partially loaded. Doors should be kept closed at all times except during actual loading operations in order to conserve refrigeration. Average of temperatures recorded at the top, middle, and bottom positions are shown in Fig. 9. The relatively high top layer temperatures in car 4 is accounted for by the much greater length of time that the doors were open during loading - 2 hours and 25 minutes as compared with one hour 20 minutes for car 5. This resulted in top air temperatures about 5° F. higher in car 4 than in car 5 which undoubtedly caused the top layer fruit to warm about 5° during standing after loading. The average rise in fruit temperatures was 3.3° for car 4 and 1.5 for car 5 which indicates that hydrocooled peaches hold their temperatures fairly well after loading in preiced cars if the cars are not left open.

Hydrocooling Tests

Most of the units observed were "Stericoolers" manufactured by Food Machinery Company but an opportunity was afforded to observe the operation of an experimental unit developed by the Durand Company, Woodbury, Ga. Both units are about the same construction except for the method of supplying the ice. Ice for the Stericooler is placed directly in the water tank and spreads throughout the unit. With the Durand unit, all ice is put into a separate narrow tank 8' long, 28" wide and 63" deep on one side of the unit. Water that has passed over the commodity is collected in a shallow pan under the conveyor and is returned to the top of the cooling tank. It is pumped from the bottom of the cooling tank back to the distributor located above the conveyor. In the Stericooler, water is pumped from the bottom of the tank where water is held at a 15" depth with ice floating over the entire area of the tank. Sodium or calcium hypochorite were used to maintain a strength of 100 to 200 p.p.m. of available chlorine in the water. This was added periodically to maintain the desired concentration to take care of dilution due to ice meltage.

The Stericooler is made in unit sizes of 25 ft., 49 ft., and 72 ft. The Durand was a single 20' unit. The amount of cooling was controlled by the time the peaches were exposed to the water spray which in turn was controlled by the speed of the conveyor belt. The actual cooling done is dependent on initial fruit temperature, water temperature and exposure time and for the most efficient operation of the cooler, water temperature and final fruit temperatures should be checked frequently.

Most of the temperature records were obtained with a two-unit Stericooler at Gramling, S.C.. Others were obtained with a one unit Stericooler and the single unit Durand at Inman. Table 2 summarizes the data obtained in six

tests. The average temperature reductions of the peaches varied from 22.4° F. to 41.2°. As may be expected the smallest reduction occurred with fruit at the lowest temperature before cooling (test 3). In all cases except test 4, fruit temperature was reduced to 50° or below. In test 4, the unit ran out of ice resulting in very high water temperatures (47°) and the time in cooler was only 8.7 minutes as compared with an average of 12 to 13 minutes for all other tests. There was a considerable range in temperatures of the fruit and cooling water before cooling and after cooling. The temperature of the water should have a smaller range during cooling. These ranges are given in parenthesis in Table 2. Variations in the temperature of fruit, both upon entry and upon leaving the cooler were as high as 15° between test packages. Cooling water varied as much as 6° during a test run. Fruit appeared to cool fairly uniformly throughout the container although the top layer was generally the coolest.

Frequent check of fruit and water temperatures should be made during operation of the hydrocooler. The importance of adequate supervision of the operation of the machine is illustrated in the observations made of a three-unit cooler. In this unit, the cooling water was covering only about 2/3 of the distributor, and two to three feet at each end of each unit was not getting water. In other words, the water curtain was only 2/3 as great as it should be, cutting down its effective performance by 1/3. In this case the 3 units were doing the job normally expected of 2 units.

Holding tests were made on a number of containers in which the container was held on the floor of the packing shed for up to 2 hours to determine the increase in temperature after cooling when the peaches were not immediately loaded into iced cars or trucks as is sometimes the case during a day's operation (Table 3). It was found that temperatures of fruit in the center of the basket continued to drop for several minutes after the peaches were out of the water, as would be expected, for it takes some time for the cooling effect to penetrate to the center of the peach in the center of the basket.

Holding tests No. 1 and 2 (Table 3) show that center fruit warm very little after an hours exposure to relatively high air temperatures. In test No. 3, (Fig. 10) temperatures were also taken in a peach against the side and top of the basket. After 1 hour, temperatures had dropped in the side and center peach but had risen 3.5° F. in the top layer. This was due no doubt to the contact of the hot pad and lid which were put on immediately after the basket was removed from the cooler. Even after the basket was held for about 2 hours and 45 minutes, the fruit at the center had risen only 3° from the minimums reached, but the side peach had risen 8° and the top fruit 14.5°. Many hydrocooled peaches are loaded into truck-trailers which are iced after loading. Based on the above data, it would appear that this practice may be satisfactory if the truck was iced within an hour after loading. However, it is quite evident that after the expense entailed in cooling the peaches every effort should be made to preserve this refrigeration by loading immediately into preiced cars or trucks.

These tests showed that the hydrocoolers were able to lower peach temperatures to about 47° F. to 50° in 12 to 16 minutes when initial fruit temperatures were in the range of 73° to 88° F. Final temperatures of 40° or lower would be preferable if the fruit was ripe and was to be shipped a long distance. The results with hydrocooling represents a great improvement over what was accomplished with fan cooling and trackside units.

Shipping Test

Average peach temperatures during the precooling or standing period are shown for the 3 test cars in Fig. 6. As previously noted, low fan speeds and a breakdown during precooling resulted in a very poor job in the fan-precooled car and lack of ice in the Stericooler prevented a proper precooling job in car 6. The delay of about 12 hours in getting this car moving in transit caused the fans to be inoperative and retarded cooling, Fig. 11. The temperature curves indicate that the top layer temperatures in all 3 cars did not reach 50° until almost 48 hours after loading and during this time the fruit had temperatures favorable for the development of decay. With adequate precooling, the fruit would have been below 50° for the entire trip.

A comparison of the ripeness of 2 lots of peaches, one picked at shipping maturity and the other somewhat more advanced and shipped in the 3 test cars is made in Table 4. The small amount of cooling accomplished by the Stericooler in this test retarded ripening slightly, but all fruit was eating ripe by the 2nd day of holding at 70° F.

The decay records obtained from the inoculated peaches are shown in Table 5. While temperatures in transit of the non-precooled and the fan-precooled car were about the same, there was a greater amount of both brown rot and Rhizopus rot in the fan-precooled car. The reason for this was not determined. Stericooled peaches had less decay than comparable fruit in the other cars. This was true for uninoculated fruit and fruit inoculated with brown rot and Rhizopus rot. The reduction in decay due to Stericooling can be attributed to the lower temperatures in transit and the fungicidal effect of the chlorine in the ice water but the relative value of each is not apparent from this experiment. While the difficulties encountered in precooling reduced the value of the data obtained in the shipping test, it did show that decay was reduced and ripening retarded even when the fruit was not cooled below 60°.

A comparison was made at shipping point in decay development in Stericooled and non-Stericooled peaches held at room temperatures of 80 to 85° F. The results given in Table 6 below indicate that Stericooling delayed the development of decay up to 4 days but by 6 days, fruit so treated caught up with the non-precooled check.

Table 6. Comparison of Decay in Stericooled and Non-Stericooled Peaches After Holding at 80 to 85° F.

Treatment	Percent Decay After Holding						
	2 days	4 days			6 days		
	Total	Brown Rot	Rhizopus	Total	Brown Rot	Rhizopus	Total
Stericooled	Less than 1%	-	-	4	17	15	32
Not Stericooled	"	15	7	22	25	8	33

Summary

In 8 tests on precooling peaches in rail cars, final fruit temperatures were found to be from 61° to 65° F. Portable precooling fans were operated for about 8 hours while the mechanical precoolers were run from 4 1/2 to 5 hours. A mechanically refrigerated rail car reduced fruit temperatures from 86° to 64° in 14 hours.

Temperatures observed in 6 hydrocooling tests indicated a satisfactory precooling job with final fruit temperatures of 45° to 55° F. Total temperature reduction was from 20° to 40° in 12 to 15 minutes. All units were capable of reducing peach temperatures to 50° or lower if properly operated. Stericooled peaches retained their low temperatures without appreciable warming for periods up to one hour when exposed to hot summer air temperatures on the packing house floor. No appreciable rise in temperature of Stericooled peaches after loading in pre-iced cars was observed.

Stericooled peaches, even though cooled to only 62° showed a reduction in both brown rot and Rhizopus after holding at destination until ripe as compared to similar peaches not Stericooled.

None of the precooling methods cooled the fruit as much as desirable to insure against development of decay and ripening.

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Table No. 1

Summary of Car Precooling Tests

No.	1	2	3	7	8	9	10	11
Location	Welford	Welford	Welford	Inman	Inman	Inman	Spartanburg	Spartanburg
Date	July 23	July 23	July 23	July 28	July 28	July 30	July 31	July 31
How Precooled	Portable fans	Non-precooled	Portable fans	Non-precooled	Preco Fan	Mech. car	Mech. unit	Mech. unit
Container	bu. basket	bu. basket	bu. basket	bu. basket	bu. basket	bu. basket	bu. basket	bu. basket
No. in car	396	396	396	396	396	429	396	396
Type car	Fan	Fan	Fan	Fan	Fan	Mechanical	Non-fan	Non-fan
Ice in bunkers								
Start	7500	8750	8750	9275	9275	----	----	----
Finish	1600	5000	3750	----	----	----	----	----
Total used	5900	3750	5000	----	----	----	----	----
Precooling Time (hours)	8.5	(9.0)	8.0	(1.75)	4.28	14.0	5.0	4.67
Ave. Temperatures:								
Start	75.5°	81.4°	84.7°	88.0°	90.2°	86.2°	86.2°	87.4°
Finish	65.0°	72.9°	63.6°	86.5°	84.2°	63.9°	62.7°	71.7°
Reduction	10.5°	8.5°	21.1°	1.5°	6.0°	22.3°	23.5°	15.7°
Outside air	87.2°	81.4°	81.3°	79°	83°	80.5°	81.0°	80.8
Cooling Rate O/hr.	1.24°	0.94°	2.64°	.86°	(1.4°)	1.6°	4.7°	3.4°

Table No. 2

Summary of Hydrocooling Tests

Test No.	1	2	3	4	5	6
Date	July 21	July 24	July 25	July 28	July 29	July 29
Location	Gramling	Inman	Gramling	Inman	Gramling	Gramling
Make Cooler	Stericooler	Durand	Stericooler	Stericooler	Stericooler	Stericooler
No. Units	2	1	2	1	2	2
Variety Fruit	Elberta	Elberta	J. H. Hale	Elberta	Elberta	J.H. Hale, Elberta
Size	2"	2"	2-3"	2"	2"	2-3" 2"
Container	3/4 bu. basket	1 1/9 bu. box	3/4 bu. basket	bu. basket	3.4 bu. basket	bu. basket
Duration of Test	4 hrs. 44 min.	2 hrs. 34 min.	1 hr. 3 min.	2 hrs. 15 min.	38 min.	1 hr. 47 min.
Ave. Water Temp. In	37.4° (5°)	35.5° (3°)	37° (3°)	46.8° (4°)	37.7° (5°)	38.2° (5°)
" " " Out	36.6° (4.5°)	35.7° (4°)	36° (5°)	47.0° (6°)	37.2° (4°)	37.9° (6°)
Ave. Fruit Temp. In	84.3° (11°)	78.3° (13.5°)	73.1° (3.5°)	88.8° (3°)	87.7° (15°)	86.9° (7°)
" " " Out	49.2° (11.5°)	49.4° (15°)	50.7° (6.5°)	61.6° (17°)	46.5° (5.5°)	46.8° (18°)
Ave. Temp. Reduction	35.1° (12.2°)	28.9° (12°)	22.4° (9.5°)	27.2° (19°)	41.2° (13.5°)	40.1° (15°)
Ave. Time in Cooler	15.7 min.	13.3 min.	13.7 min.	8.7 min.	12 min.	12.1 min.
Ave. Cooling Rate	2.2°/min.	2.17°/min.	1.6°/min.	3.13°/min.	3.43°/min.	3.31°/min.
Ave. Air Temp.	87° (6.5°)	95° (2°)	82° (2°)	85° (3°)	92° (1°)	92° (2°)
No. Test Baskets	16	13	7	12	6	17

Note - Figures in parenthesis indicate range of temperature.

Table No. 3

Tests of Warming of Stericooled Fruit Exposed to Outside Air

Test No. 1

1 1/9 bu. Sparton Box - Cooled by Durand Hydrocooler

Lid Off			Lid On		
Time	Air Temp.	Fruit Temp.*	Time	Air Temp.	Fruit Temp.*
Minutes	°F.	°F.	Minutes	°F.	°F.
0	95	43.0	0	96	47.5
8	95	45.0	18	96	47.0
14	95	46.5	25	96	47.5
24	96	47.5	43	96	49.0
38	96	48.5			
45	96	49.0			
63	96	50.0			

*Temperature of peach 3" from top and in center of box.

Test No. 2

3/4 bu. basket - Stericooled - lid on basket

Basket No. 1			Basket No. 2		
Time	Air Temp.	Fruit Temp.*	Time	Air Temp.	Fruit Temp.*
Minutes	°F.	°F.	Minutes	°F.	°F.
0	81	49.0	0	81	49.0
14	82	44.0	16	83	43.0
20	83	43.5	20	83	42.5
36	82	43.0	33	82	43.5
42	82	43.5	39	82	43.5
49	82	43.5	45	82	43.5

*Fruit temperature in peach in center line of basket 3-4" from top.

Test No. 3

3/4 bu. basket - Stericooled - lid on basket

		Fruit Temperature		
Time	Air Temp.	Middle Centerline	Middle Side	Top Centerline
Minutes	°F.	°F.	°F.	°F.
0	92	59.5	63.0	54.0
25	92	55.0	58.0	52.0
60	92	55.0	60.5	57.5
80	92	56.5	61.5	59.5
110	93	56.5	63.0	63.0
130	93	56.5	64.0	64.5
166	92	58.0	66.0	66.5

Table 4. Effect of precooling on firmness (ripeness) of peaches
(Pressure test in pounds)

Treatment	Maturity	At Loading	Arrival	1 day	2 days
Stericooled	shipping	11.45	7.6	4.7	3.1*
Fan-Precooled	"	11.45	5.0	3.6*	3 *
Non-Precooled	"	11.45	4.1	3.6*	3
Stericooled	advanced	10.8	4.4	3.4*	3
Fan-Precooled	"	10.8	3.4	3	3
Non-Precooled	"	10.8	3.5	3	3

*Eating ripe

Table 5

Decay in Test Packages Upon Arrival in New York and After Holding at 70°. All Peaches Usual Shipping Maturity

Treatment	Inoculation	Arrival: Brown Rot	Arrival: Rhizopus	Arrival: Total	After 2 days holding (cumulative): Brown Rot	After 2 days holding (cumulative): Rhizopus	After 2 days holding (cumulative): Total
		%	%	%	%	%	%
Stericooled	none	0	0.8	0.8	0.4	0.8	1.2
Fan-precooled	"	0	0	0	2.8	0	2.8
Non-precooled	"	0	0	0	2.5	0	2.5
Stericooled	brown rot	0	0	0	3.3	0	3.3
Fan-precooled	"	0	0	0	13.9	1.4	15.3
Non-precooled	"	0	0	0	8.6	0.5	9.1
Stericooled	Rhizopus	0	3.5	3.5	0	29.7	29.7
Fan-precooled	"	0.4	9.0	9.4	0.4	42.6	43.0
Non-precooled	"	0	10.0	10.0	0	40.7	40.7

Figure No. 1

Average Peach Temperatures During Precooling

Car 1 & 3 Precooled Portable Fans
Car 2 Non-Precooled (Check)

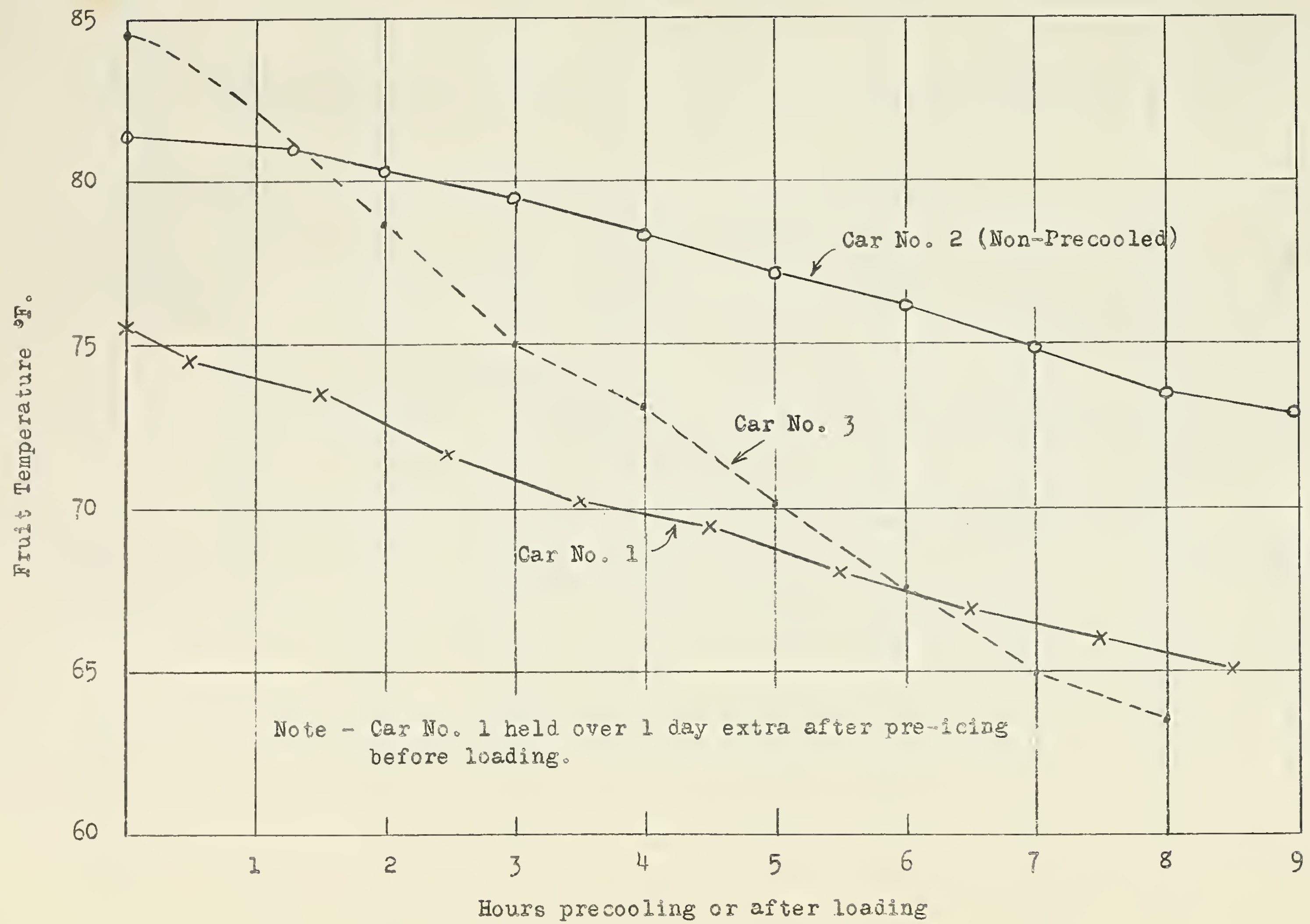


Figure No. 2

Temperature of Air Blast and Return

Cars 1 and 3
Portable Precooling Fans

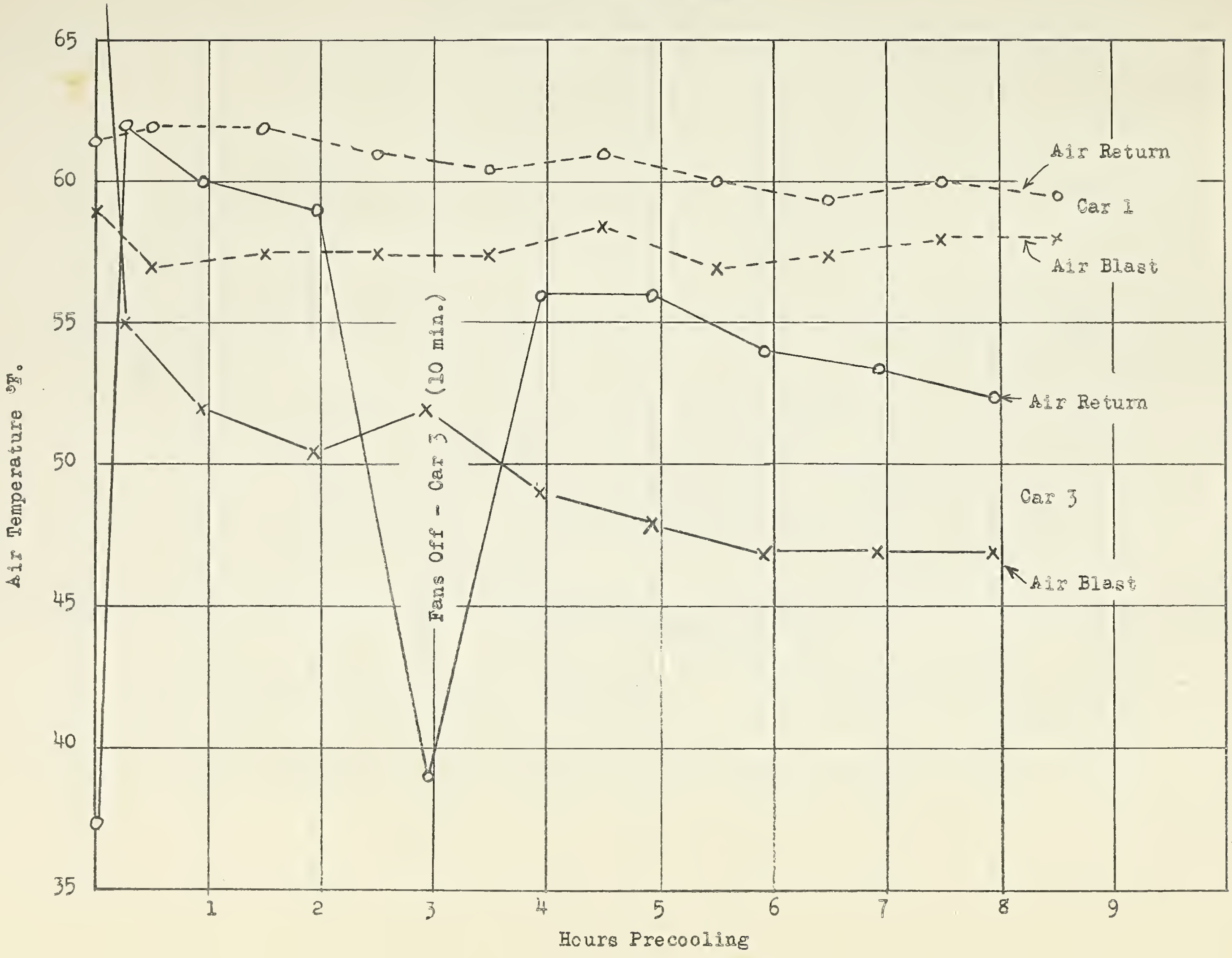


Figure No. 3

Precooling Temperatures

Car No. 1
Precooled with Portable Fans

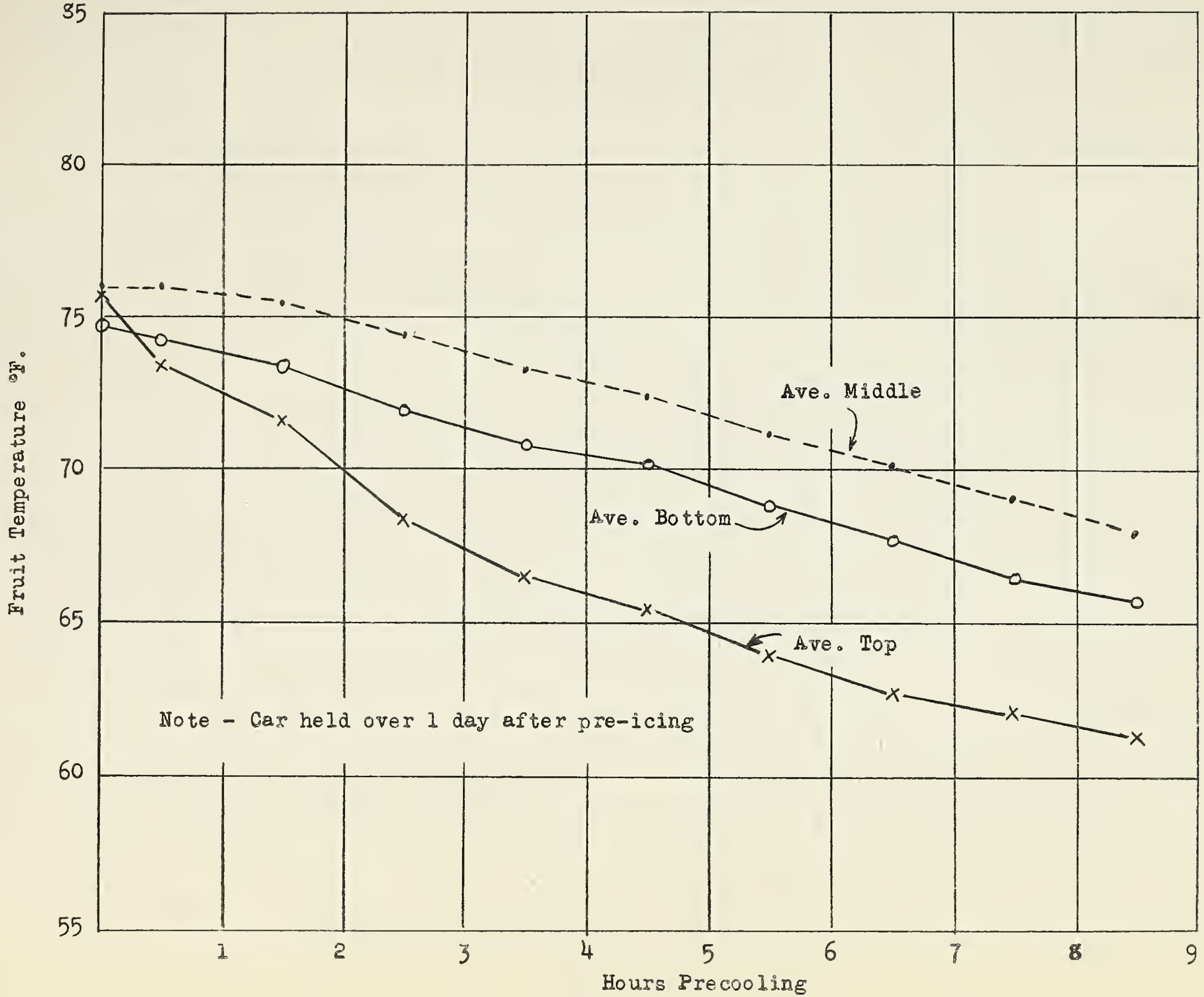


Figure No. 4

Average Peach Temperatures After Loading

Car No. 2 Non-Precooled

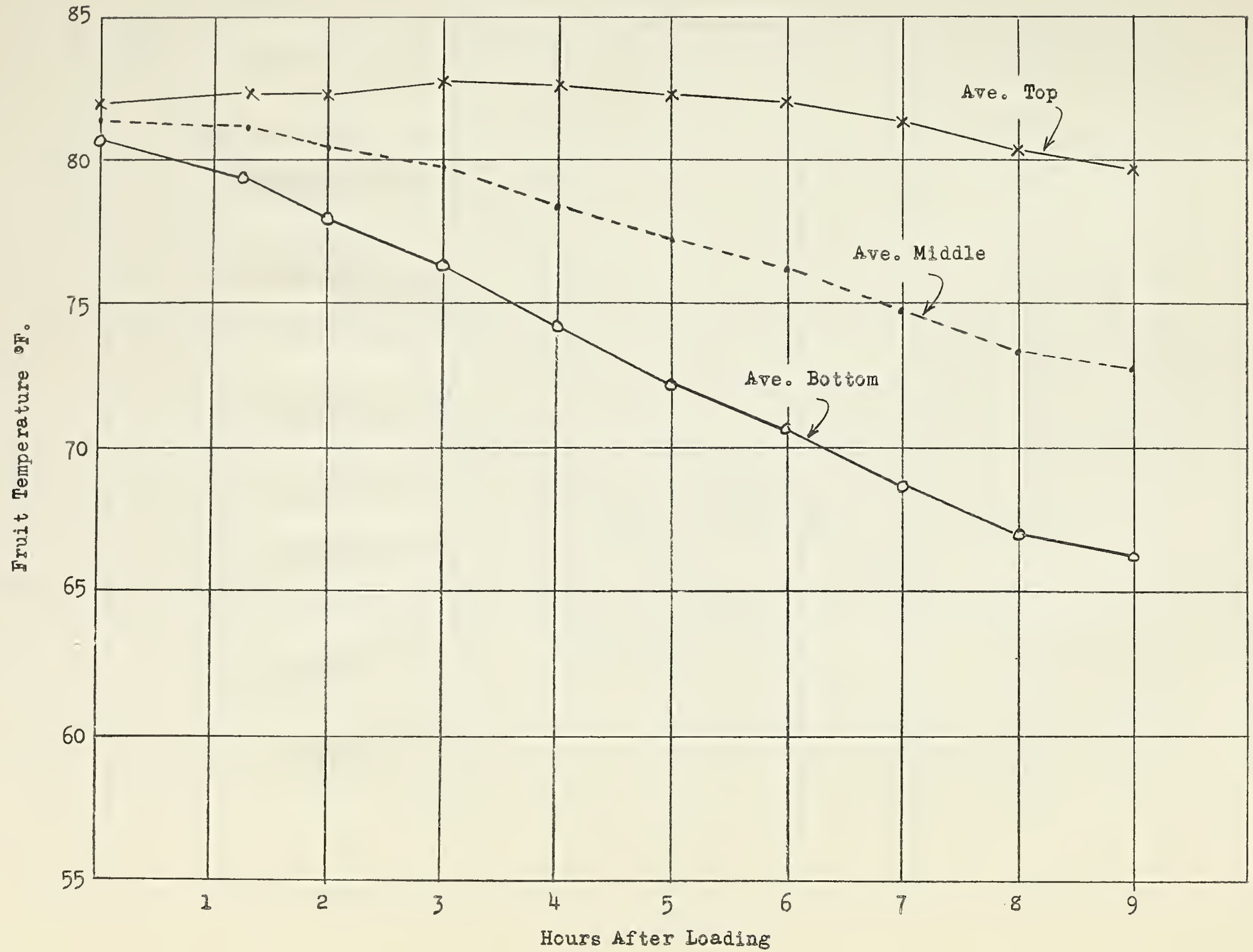


Figure No. 5

Average Peach Temperatures During Precooling
Car No. 3

Precooled with Portable Fans

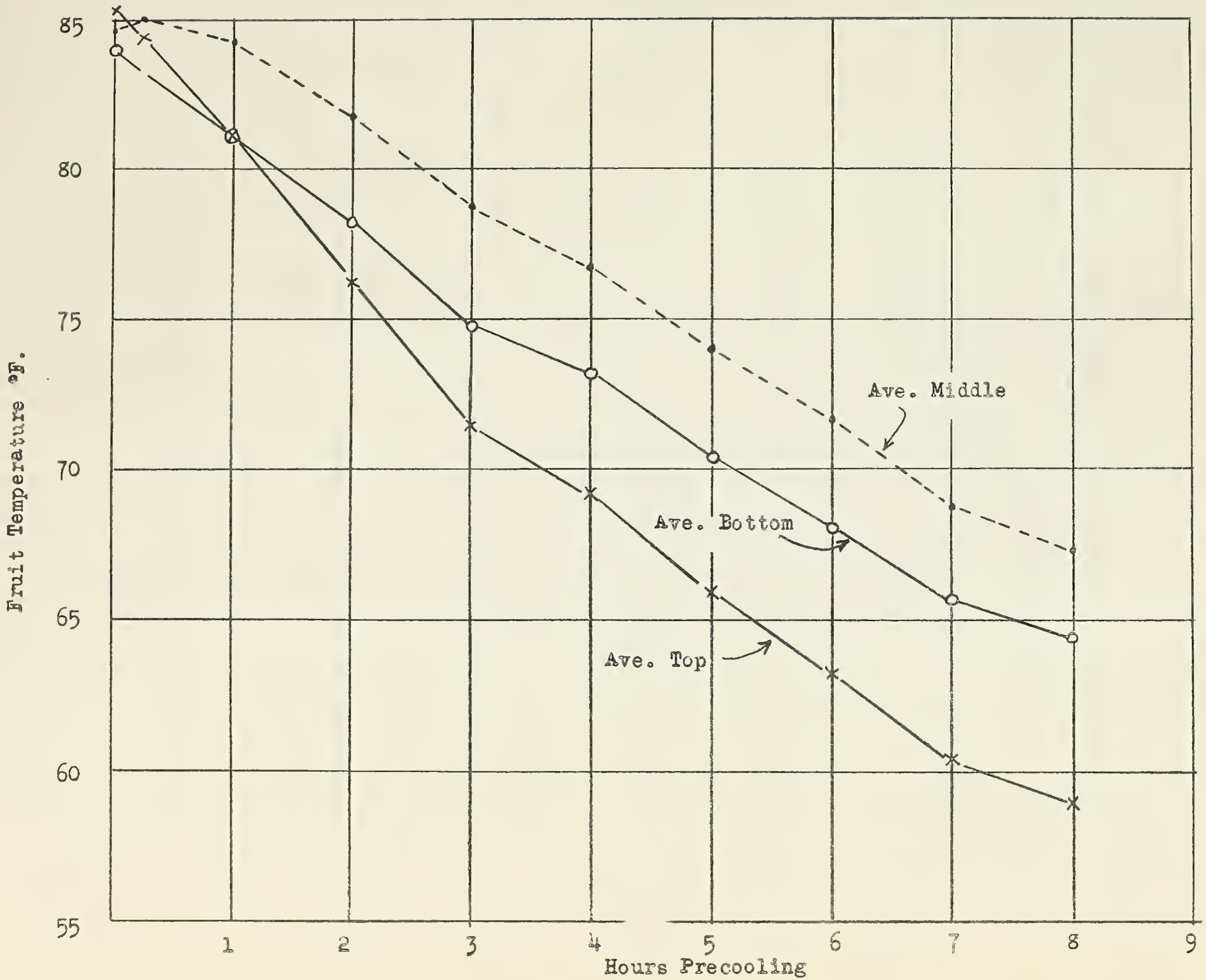


Figure No. 6

Average Fruit Temperature During Precooling or After Loading
Car 6 - hydrocooled
" 7 - non-precooled (check)
" 8 - car fan precooled

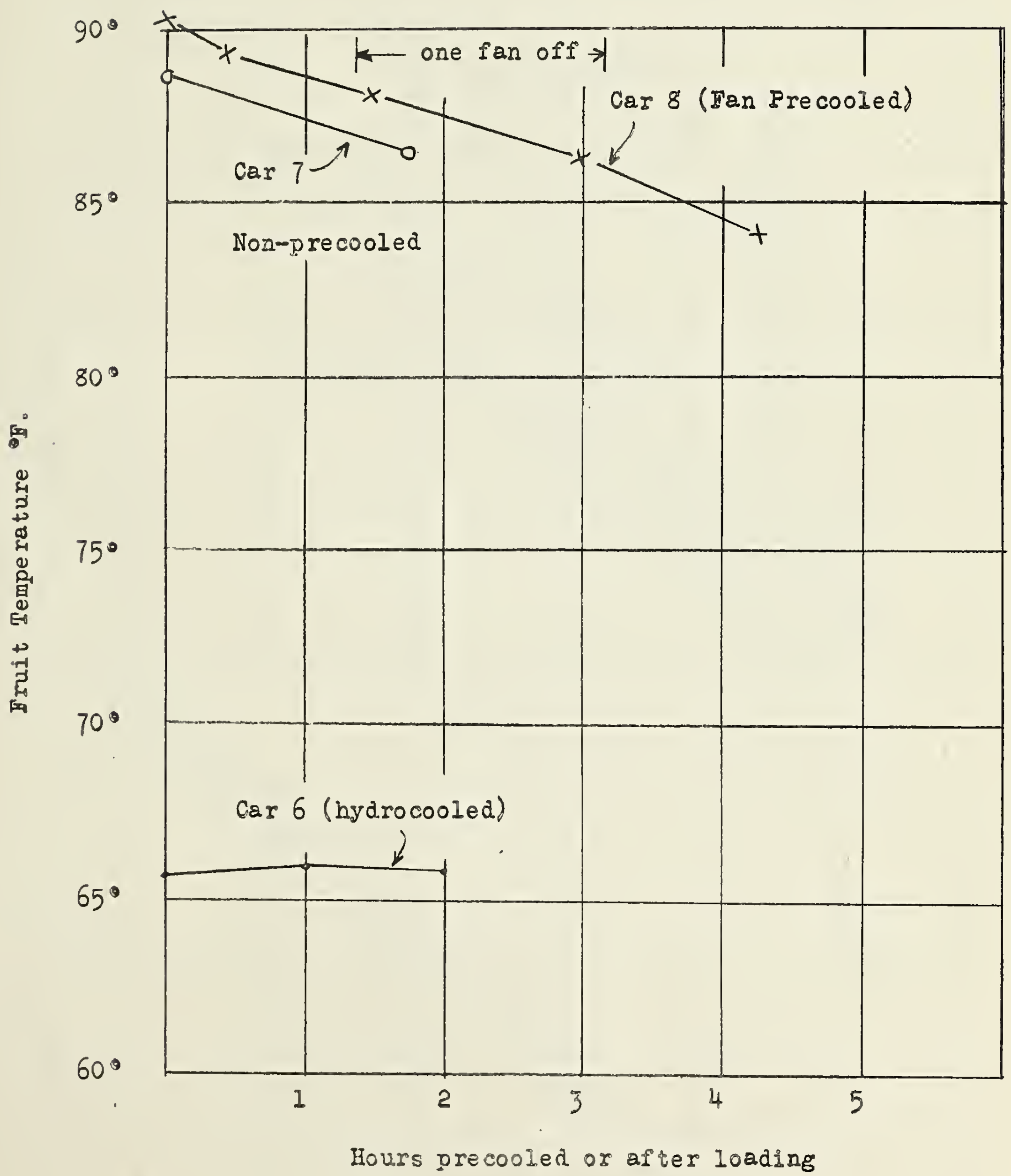


Figure No. 7
Average Top, Middle & Bottom Fruit Temperatures
Cars Precooled by Trackside - Mechanical Cooler
Cars 10 and 11

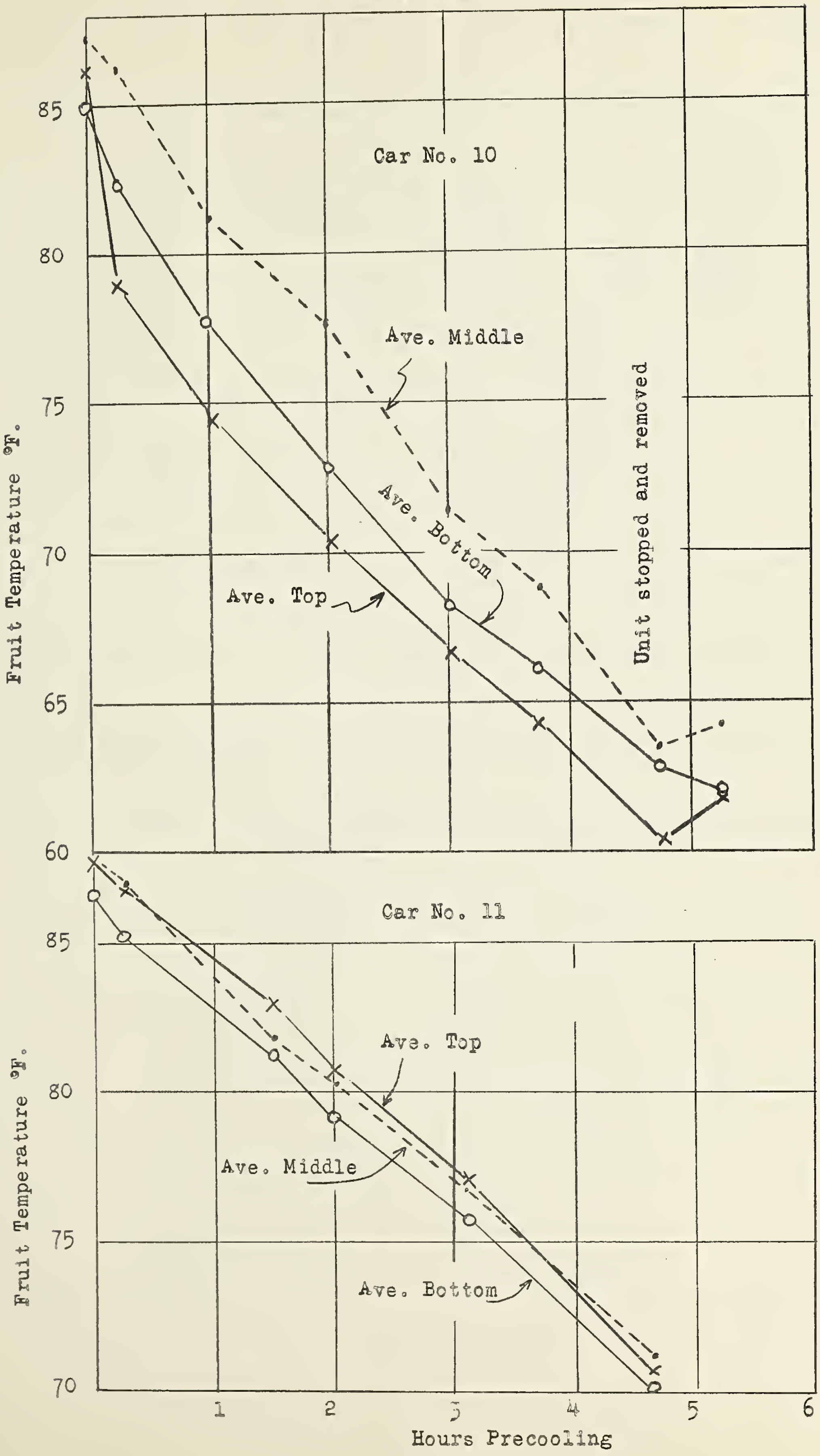


Figure No. 8

Peach Temperatures During Precooling

Mechanically Refrigerated Car

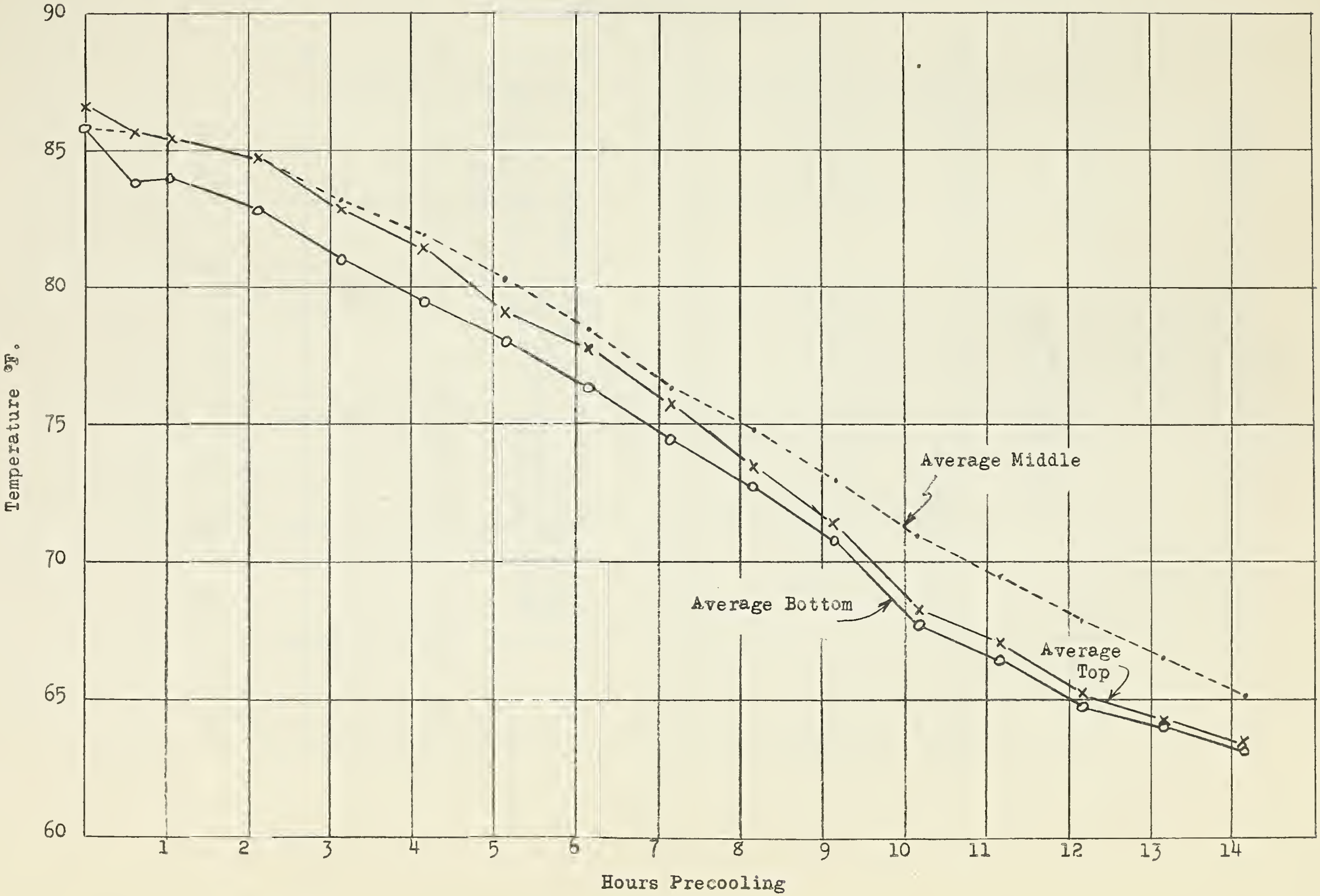


Figure No. 9

Temperatures of Hydrocooled Peaches After Loading
in Pre-iced Car

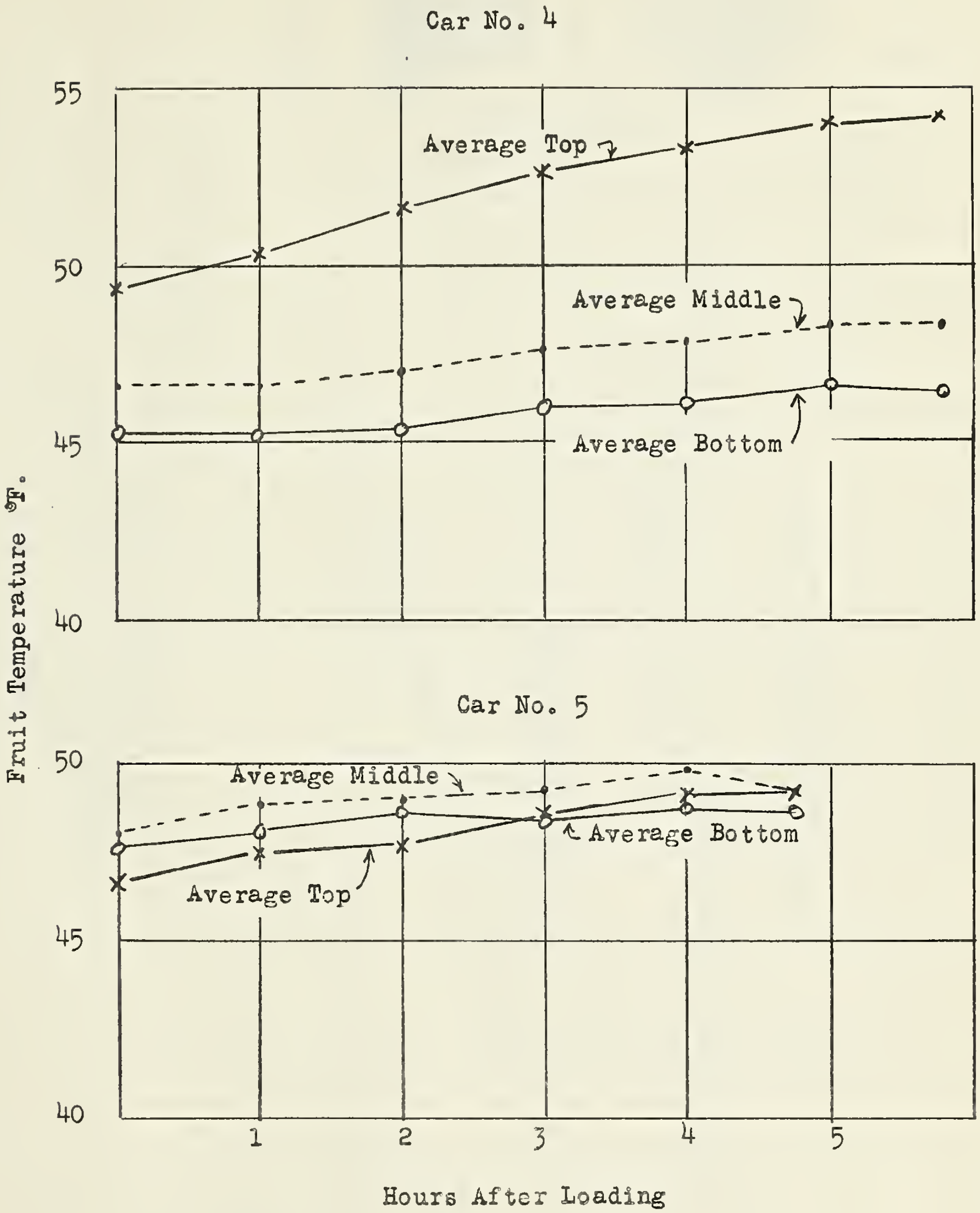


Figure No. 10

Holding Test After Stericooling

3/4 bu. basket - Lid on

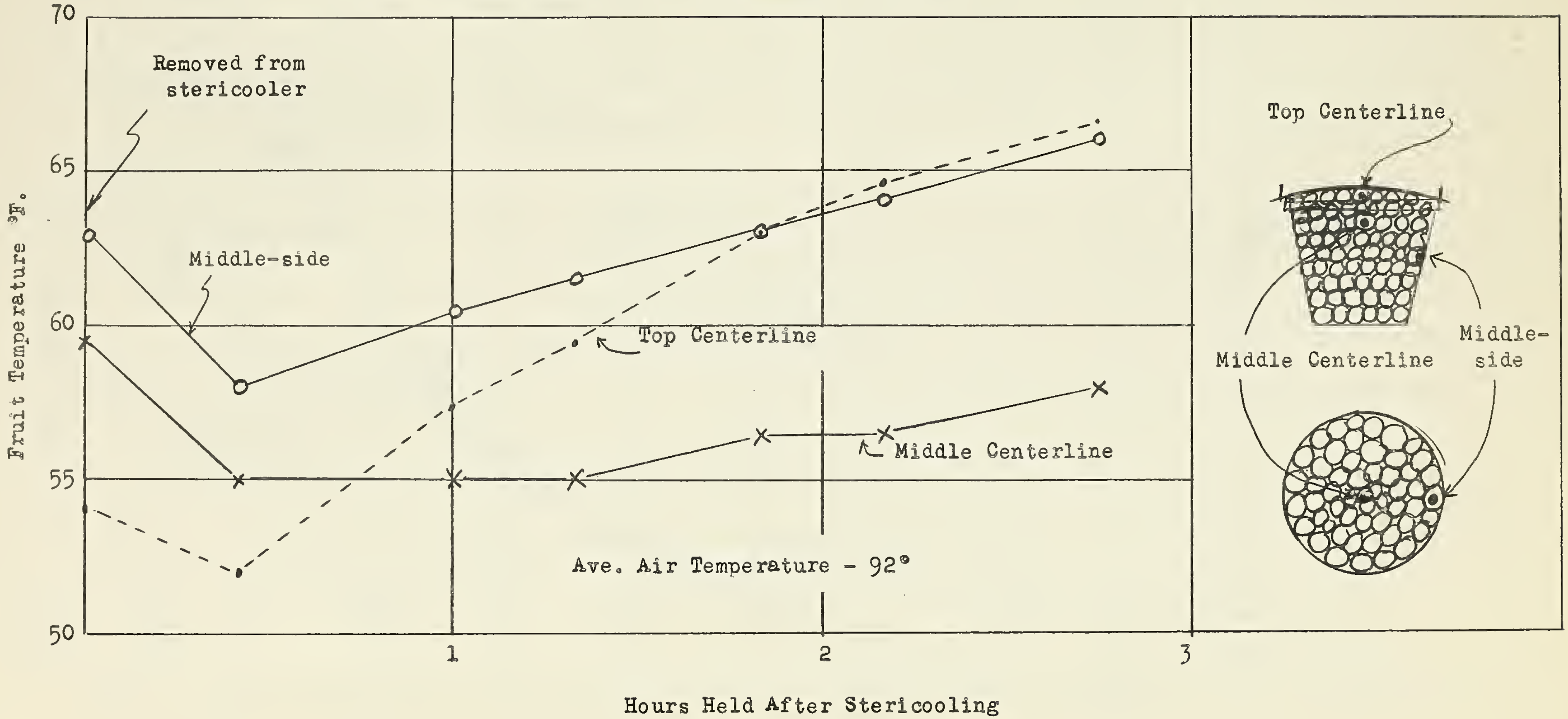
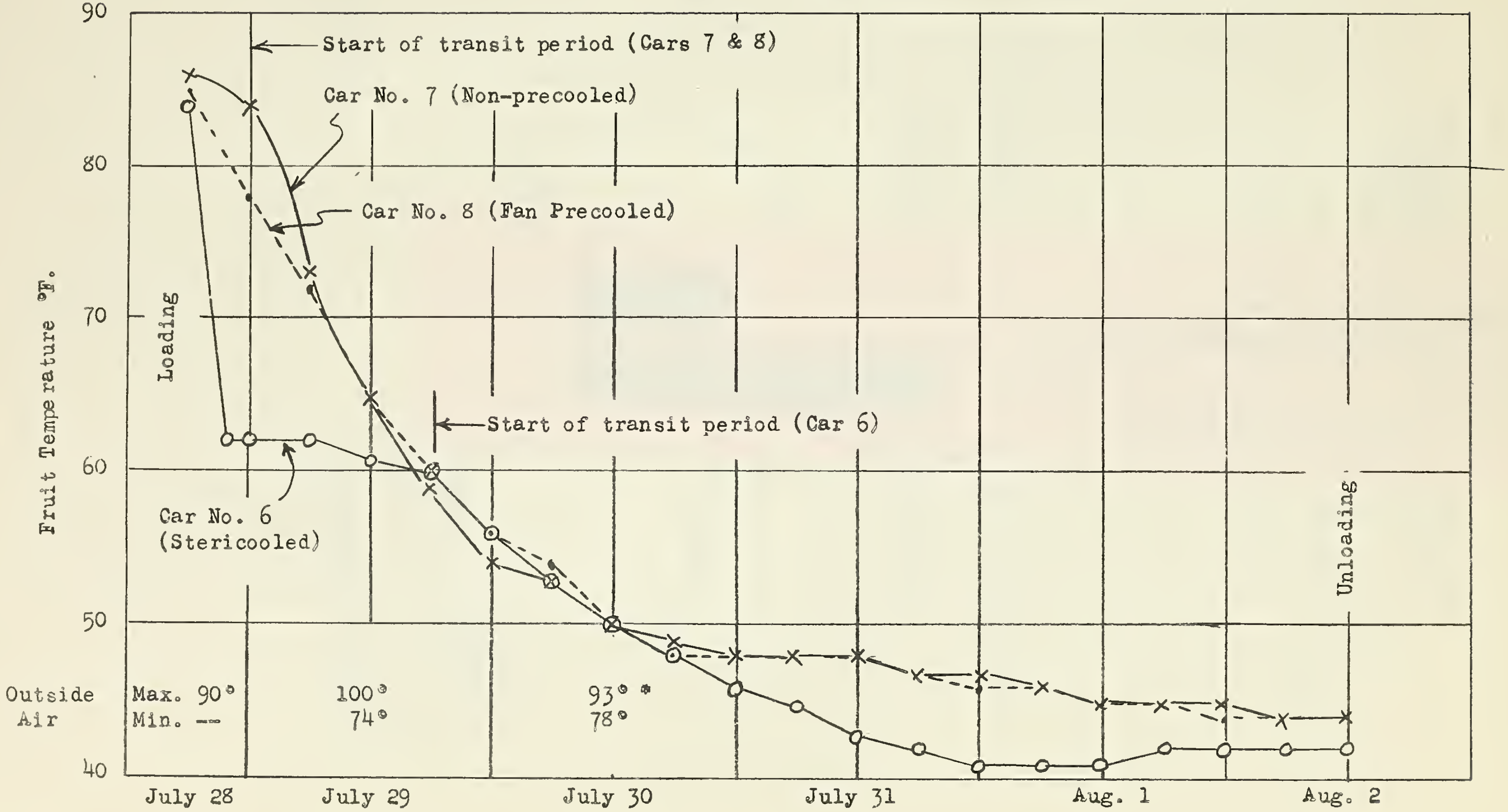


Figure No. 11

Peach Temperatures in Transit

Top Doorway Position
Fan Cars - Fans On



*Outside air thermometer failed to ink after noon July 30.